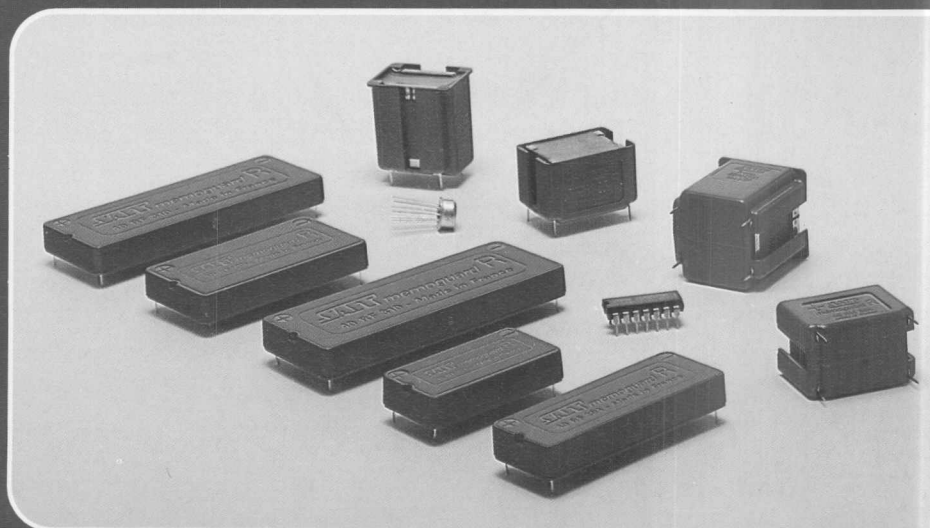
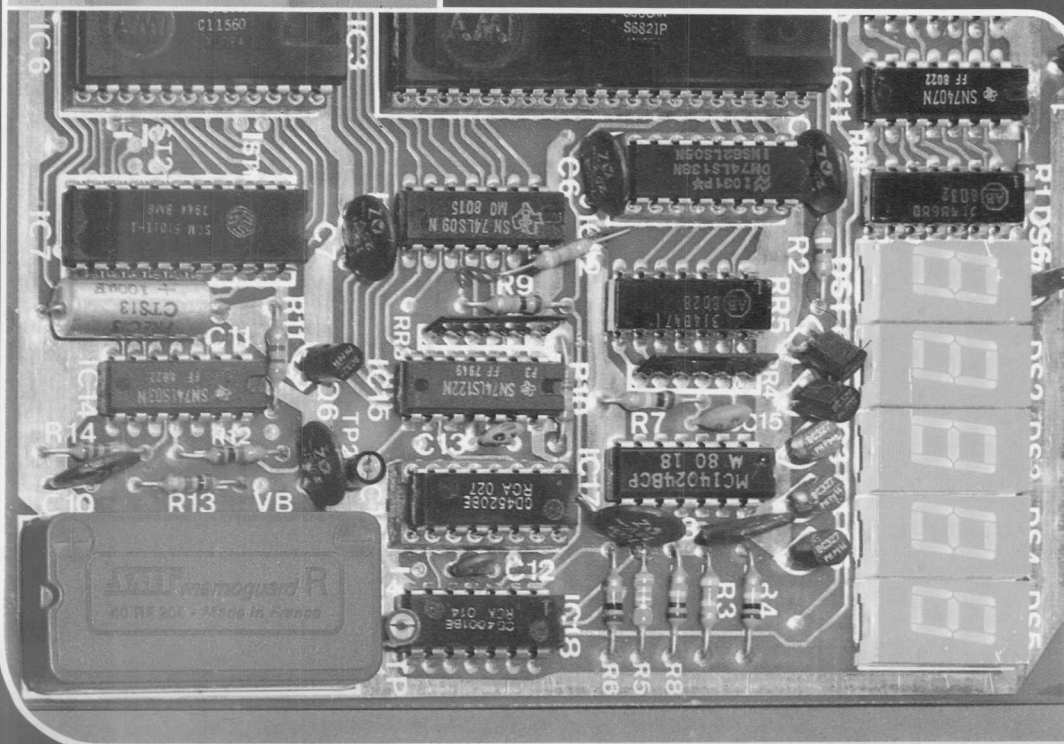


Sealed rechargeable Nickel-Cadmium cells VB series



Telecommunications,
Electronics-Signalling,
Emergency power applications.



AN
ANSWER
TO
EVERY
NEED

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The SAFT nickel-cadmium cell designed with extra-thin plates constitutes the ideal power or energy source, even under the harshest environmental conditions, whenever its use requires high performance, maximum reliability, extremely long life, together with reduced size and weight.

1. Principal advantages

- Sealed - Absolute freedom from maintenance.
- Indefinite shelf life.
- Extremely long life and reliability.
- Substantially flat voltage characteristic even at every high discharge rates.
- Operating temperatures from -40°C to $+50^{\circ}\text{C}$
- Shockproof and vibration-proof construction.

2. Applications

Thanks to their outstanding performance, SAFT VB sealed nickel-cadmium cells are the most suitable energy source :

For portable devices requiring an independant power supply :

- Telecommunications,
- Remote radio and ultrasonic controls,
- Photo-flashes, cine cameras,
- Pocket calculators,
- Tests and control equipment,
- Toys.

For the supply of emergency systems :

- Telephony,
- Computer systems (memory backup or logic circuits),
- Relay backup,
- Time bases.

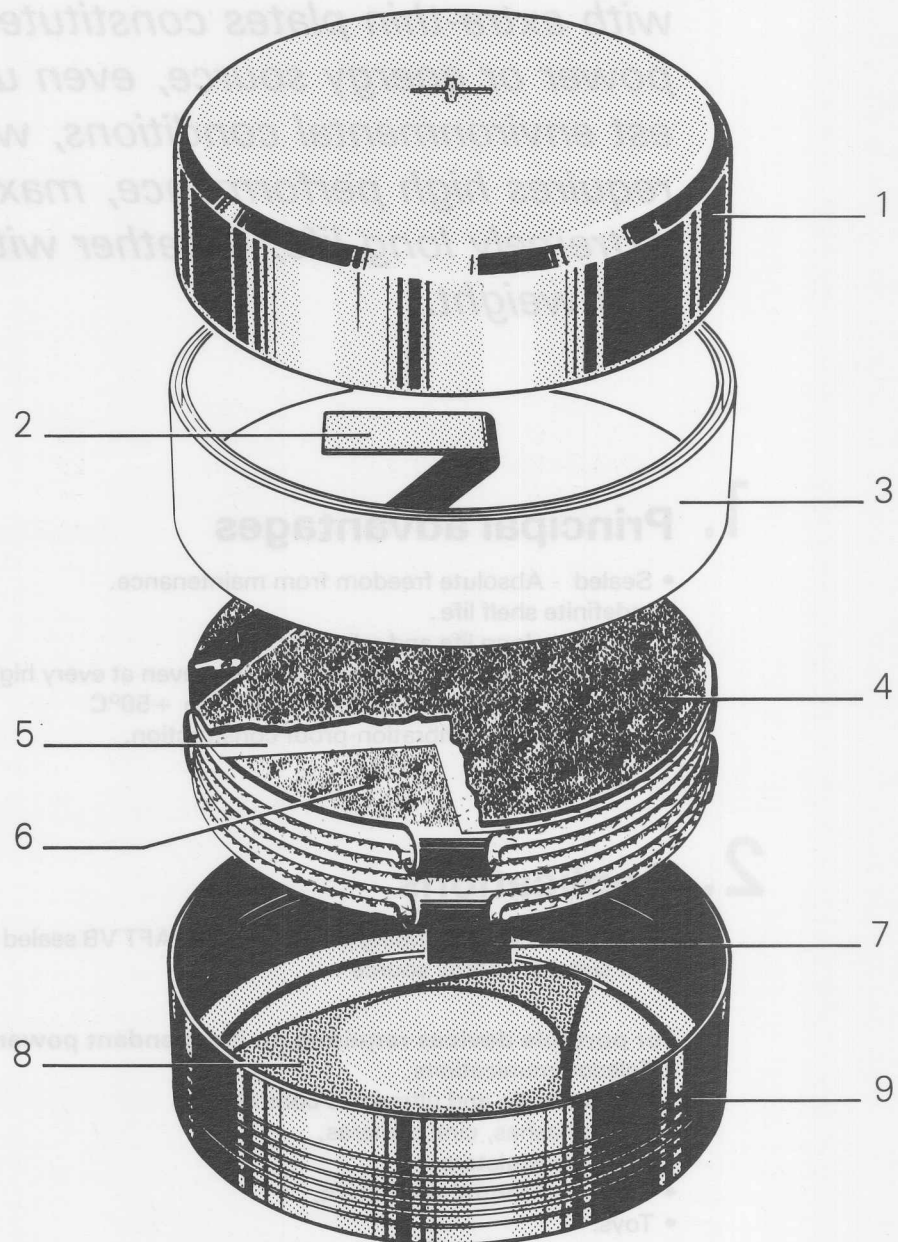
3. Description

SAFT VB type sealed nickel-cadmium button cells comprise :

- Thin sintered plates,
- Porous separator,
- Alkaline electrolyte,
- Nickel plated steel cups,
- Insulating seal.

**Exploded view
of VB 22 E cell**

1. Positive cup
2. Positive connection
(welded to cup 1)
3. Insulating ring
4. Positive plate
5. Separator
6. Negative plate
7. Negative connection
8. Spring
9. Negative cup



4. Characteristics

Nominal voltage : 1.20 volts per cell.

Rated capacity C_5^* (at 20°C) : capacity in ampere-hours (Ah) obtained at the five hour rate of discharge (0.2 C_5 A) to an end voltage of 1.10 V/cell, after a normal charge of 16 hours at 0.1 C_5 A.

Rates of charge or discharge are expressed with respect to the rated capacity.

Example :

0.2 C_5 A corresponds to 20 mA for a cell of $C_5 = 100$ mAh,

5 C_5 A correspond to 500 mA for a cell of $C_5 = 100$ mAh.

* International standards allow a tolerance of - 5 % on this value.

VBE SERIES CELLS					
Type	Ref. CEI 509 KBH	Rated capacity C_5	Maximum dimensions		Max weight
		mAh	Diameter mm	Thickness mm	g
VB 4 E	16/7	40	15.7	6.0	3.5
VB 10 E	23/6	100	23.0	5.3	7
VB 22 E	26/8	220	25.1	7.8	12
VB 30 E	35/6	300	34.7	5.5	18
VB 60 E	35/10	600	34.7	9.8	31

In the family of Series VB cells, SAFT offers, in addition to the VBE cells, a line of VBM cells designed for use in industrial electronics providing improved high-temperature performance, which is described in a separate manual.

Other series of SAFT leakproof nickel-cadmium cells are also available :

VR : cylindrical from 110 mAh to 10 Ah,

VT : cylindrical for continuous charge at high temperature,

VY : cylindrical for uncontrolled rapid charge,

VRE and VBES : severe mechanical stresses (missiles),

VOS : space applications (satellites),

which, due to their particular performance, range of capacities and various shapes, allow an optimum choice for each application.

5. Mounting in batteries

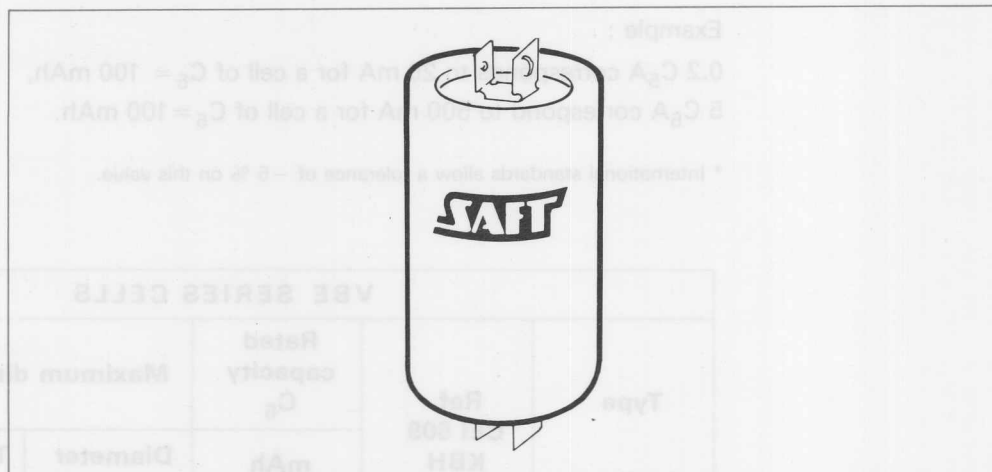
VB cells are used in battery packs consisting of a number (N) of cells of the same type connected in series in a rigid case.

Nominal voltage of the pack : $N \times 1.20 \text{ V}$.

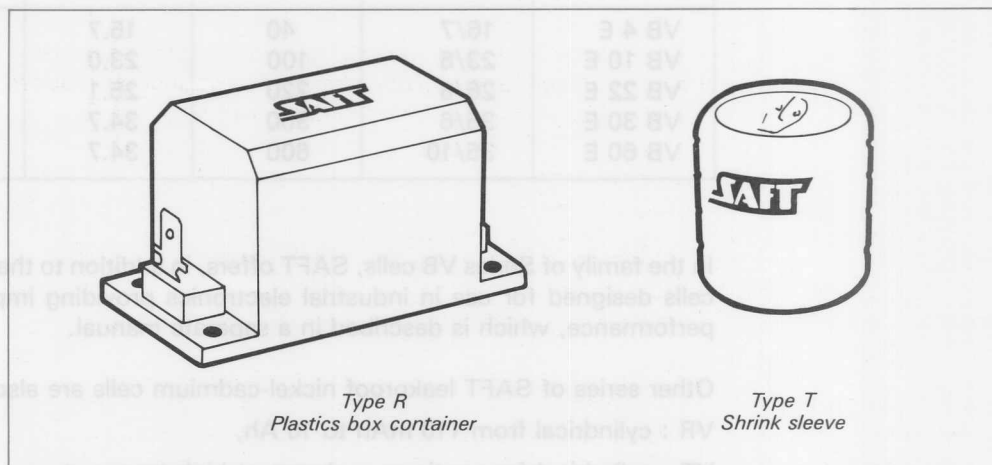
Rated capacity of the pack : capacity of one cell of the type used.

SAFT has designed standard battery packs to help the user to obtain the maximum performance of the VB cells.

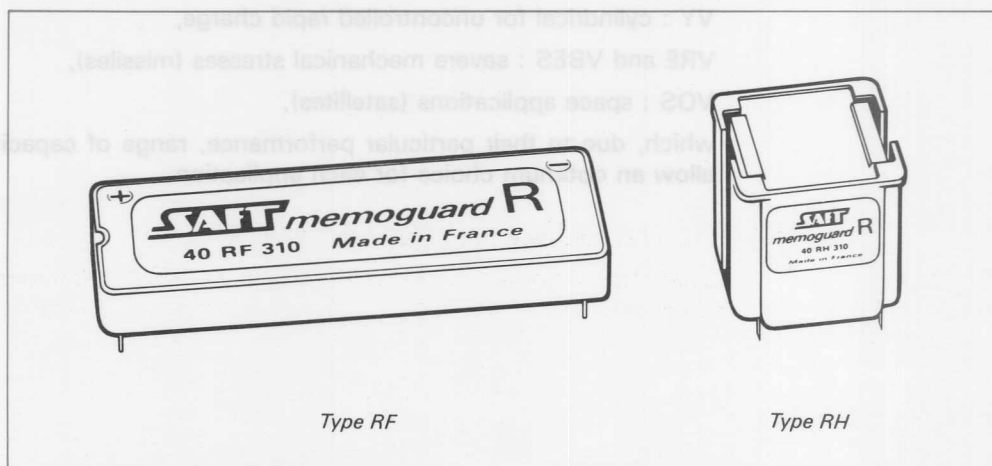
Standard VBE battery
(plastics outer shell)



Other VBE assemblies



Series VBM
Memoguard R battery

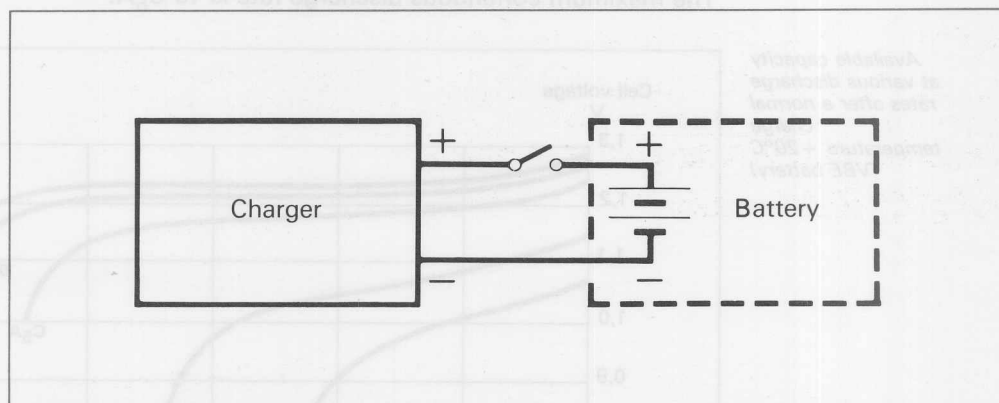


Should none of these packs meet your requirements, our engineers will help you to design a suitable battery.

For memory back-up applications, refer to the Memoguard R battery manual.

6. Charging

VBE cells are charged at a substantially constant current.



Various charging methods can be considered according to the application requirements :

- Application**
- **Normal charge** (regardless of initial state of charge)
Maximum rate = $0.1 C_5A$ for 16 hours.

An occasional overcharge at the above rate, beyond the prescribed time, is not detrimental to the cells.

When the temperature of the cells is below $+10^{\circ}C$, the charging voltage must be limited to 1.55 V/cell, alternatively charging rate must be reduced in accordance with the data given for each cell. Refer to data sheets.

- **Rapid charge**

Fully discharged VBE batteries can support charging rates of more than $0.1 C_5A$.

Example :

50 minutes at C_5A (between $+10^{\circ}$ and $+40^{\circ}C$), restored capacity : about 80 % of capacity.

Application with continuous charge (emergency)

To maintain batteries in the fully charged condition over long periods of time, it is necessary to compensate for occasional discharges and self-discharge by means of a continuous low-rate charge.

The recommended current is a function of :

- the frequency of discharge,
- the capacity required,
- the time available to recharge the capacity,
- the temperature.

The rates can vary from 0.005 to $0.05 C_5A$.

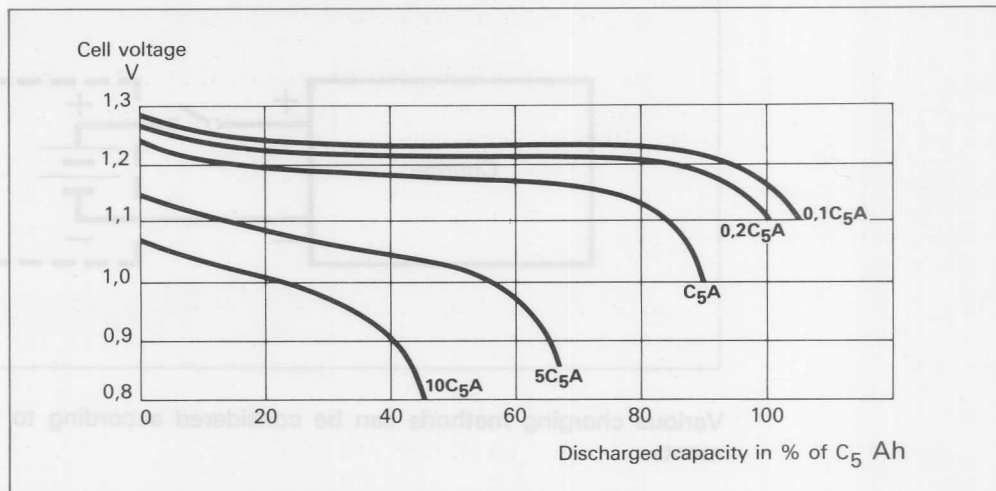
When the continuous charge rate is below $0.02 C_5A$, the battery should be given a normal charge ($0.1 C_5A$ for 16 hours) before it is put into service.

7. Discharging

SAFT VBE battery packs can deliver very high currents.

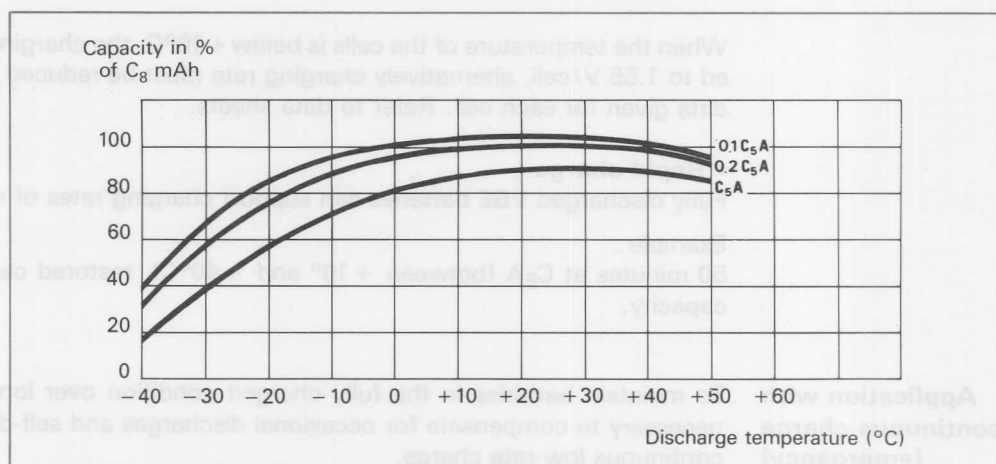
The maximum continuous discharge rate is $10 C_5 A$.

Available capacity
at various discharge
rates after a normal
charge
temperature $+20^\circ C$
(VBE battery)



VBE cells provide excellent performance over a wide temperature range (-40° to $+50^\circ C$).

Available capacity
between $-40^\circ C$
and $+50^\circ C$ at
various
discharge rates
(after normal charge
at $+20^\circ C$)



8. Life and reliability

The service life of VBE cells can extend over ten years. However, this depends on operating conditions and is influenced principally by the depth of discharge (discharged capacity)

(rated capacity) in a cycling application, or by the number of ampere-hours over-charged in a continuous charge application.

Cycling

- Approximately 500 cycles with 100 % depth of discharge.
- Approximately 2 000 cycles with 50 % depth of discharge.

Continuous charge

The high reliability of VBE cells makes them compatible with most industrial electronics components.

For example after five years of continuous charge at $0.05 C_5 A$, the failure rate for VBE cells is not greater than 5 per 1000.

9. Maintenance

VB cells and batteries require NIL maintenance.

10. Charge retention

VBE cells exhibit good charge retention, especially at lower temperatures. For instance, after one month of storage at $+20^{\circ}\text{C}$, a fully charged cell will deliver approximately 80 % of its capacity.

11. Shelf life

The performance of VBE nickel-cadmium cells is not permanently affected by prolonged storage, regardless of their initial state of charge or the temperature (-40° to $+50^{\circ}\text{C}$).

However, the most favourable storage conditions are :

- Temperature : between 5° and 25°C ,
- Relative humidity below 80 % (without condensation),
- Cells in free air and on open circuit.

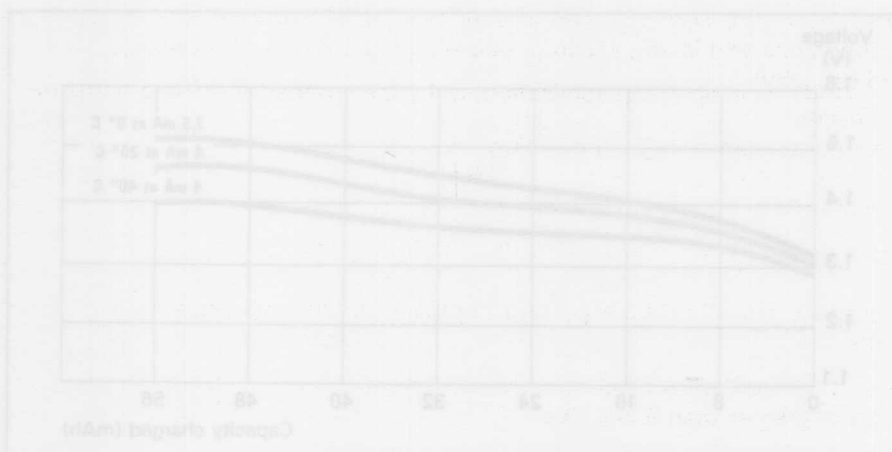
12. Transport

The mechanical strength of VBE cells and VBE standard battery packs is excellent. They can be shipped under the most severe conditions. For example : shocks of 40 g for 6 ms at the rate of 2 to 3 shocks per second.

Note : After being transported by air, any condensation found to exist on cells or batteries, due to thermal shocks, should be dried before prolonged storage. Free air is usually sufficient.

Charge time (h)	Am	$^{\circ}\text{C}$
100	0.4	-30
50	0.8	-20
30	1.0	-10
20	2.0	0
10	4	+10

Note : Occasional overcharges at these rates beyond the prescribed times is not detrimental to VB-E cells.



VB
4E

Cell type VB 4 E

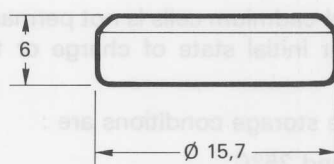
(CEI : KBH 16/7)

Rated capacity

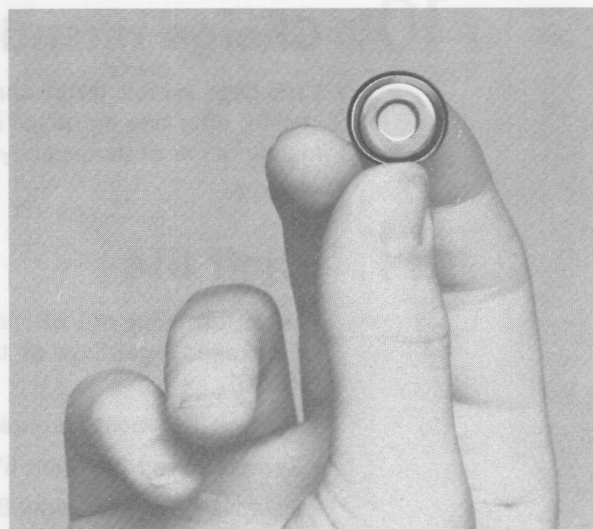
C₅ : 40 mAh

Nominal discharge

voltage 1.20 V



Max. dimensions in mm
Max. weight : 3.5 g



1. Electrical performance

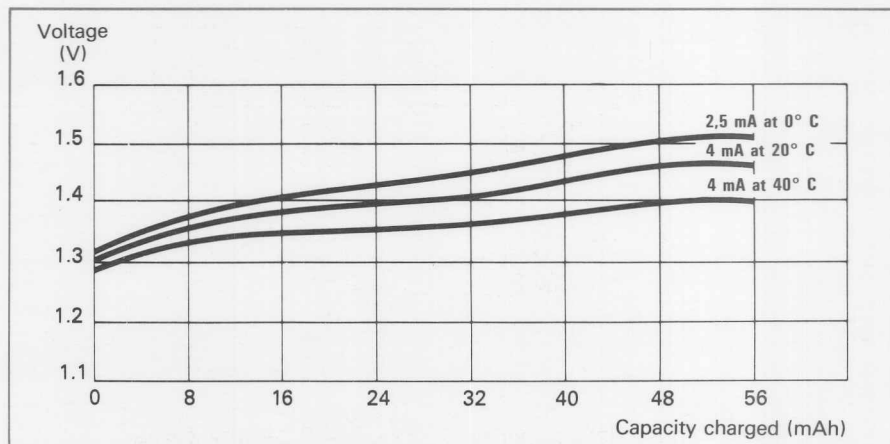
1. CHARGE A. Normal charge (irrespective of state of charge)

- from +10°C to +50°C : 4 mA for 16 hours.
- from -30°C to +10°C :

Temperature	Maximum charge rate	Charge time
°C	mA	h
-30	0.4	100
-20	0.8	55
-10	1.5	30
0	2.5	20
+10	4	16

Note : Occasional overcharges at these rates beyond the prescribed times is not detrimental to VB 4 E cells.

*Cell voltage for various
charging rates
and temperatures*



B. Rapid and ultra-rapid charge

A larger or smaller part of the capacity can be charged in times from a few seconds to an hour with chargers approved by SAFT.

C. Continuous charge

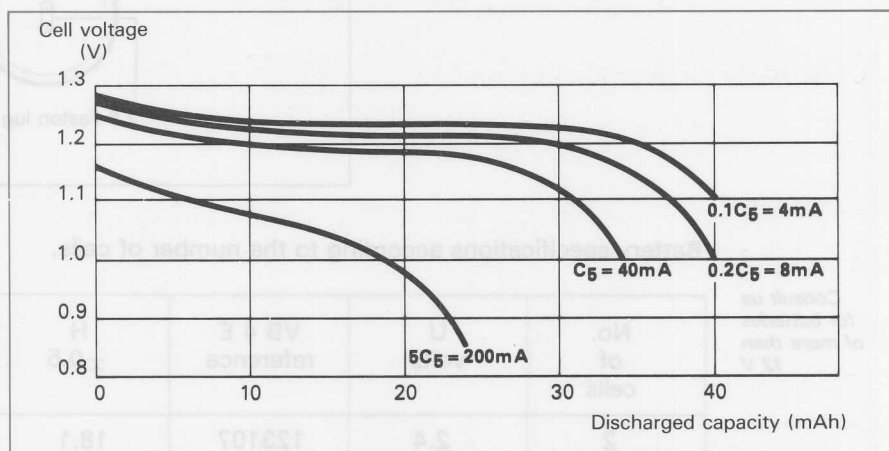
The continuous charge rate can vary from 0.2 mA to 2 mA.
Maximum rates depend on the temperature.

Temperature	Max. continuous charge rate
°C	mA
-30	0.2
-20	0.4
-10	0.8
0	1.2
+ 10 to + 50	2

2. DISCHARGE

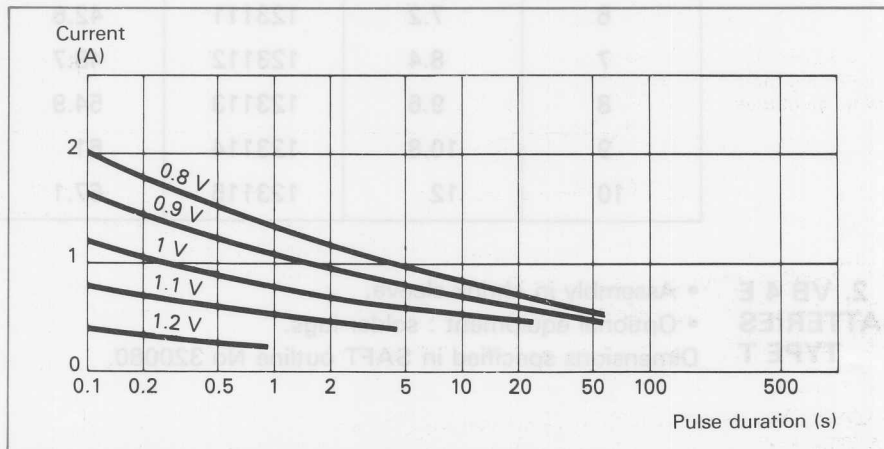
Continuous discharge at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
Maximum permissible continuous rate : 200 mA.

Voltage and capacity for various discharge rates



Pulse discharge at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ (100 % charged).
Maximum power for a 0.3 s pulse : 1.5 W ($V = 0.65 \text{ V} - I = 2.3 \text{ A}$).

Cell voltage for a pulse discharge of a given current and duration



Note : These data apply to SAFT VB 4 E battery packs.

2. VB 4 E battery packs

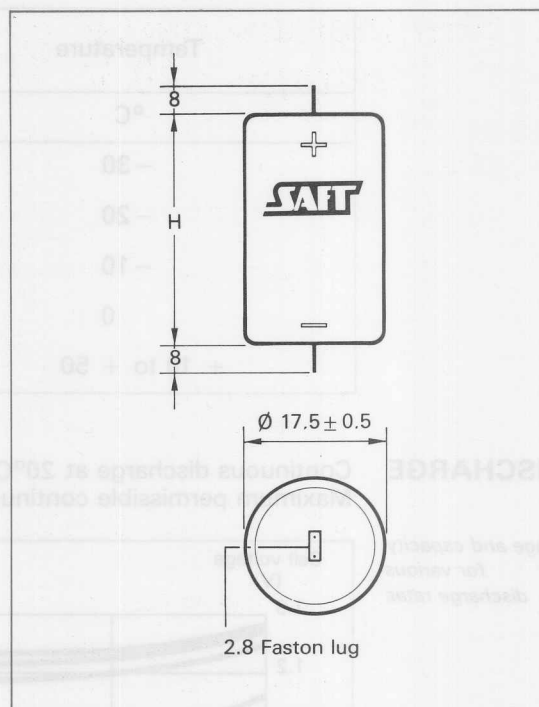
1. STANDARD BATTERIES OF VB 4 E CELLS

Rated capacity $C_5 = 40 \text{ mAh}$
Nominal voltage = 2.4 to 12 volts

A. Description

- Assembly in rigid plastics tube.
- Output terminals : 2.8 mm Faston lugs which may be used as solder lugs (drilled 1 mm dia.).

B. Dimensions (in mm)



Battery specifications according to the number of cells.

*Consult us
for batteries
of more than
12 V*

No. of cells	U volts	VB 4 E reference	H ± 0.5	Max. weight (g)
2	2.4	123107	18.1	13
3	3.6	123108	24.2	16
4	4.8	123109	30.3	20
5	6	123110	36.5	24
6	7.2	123111	42.6	28
7	8.4	123112	48.7	32
8	9.6	123113	54.9	37
9	10.8	123114	61	41
10	12	123115	67.1	45

2. VB 4 E BATTERIES TYPE T

- Assembly in shrink sleeve.
 - Optional equipment : solder lugs.
- Dimensions specified in SAFT outline No 320080.

Note : For memory backup applications refer to «Memoguard R» battery manual.

Cell type VB 10 E

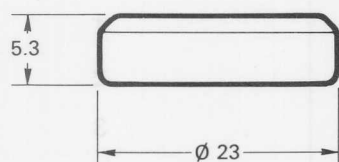
(CEI : KBH 23/6)

Rated capacity

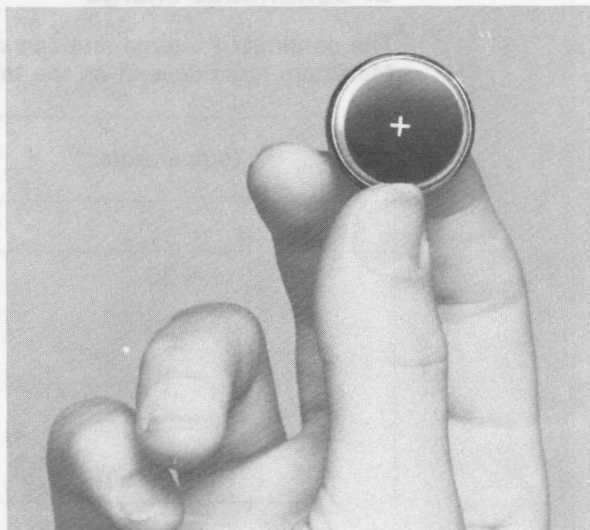
C_5 : 100 mAh

Nominal discharge

voltage 1.20 V



Max. dimensions in mm
Max. weight : 7 g



VB
10E

1. Electrical performance

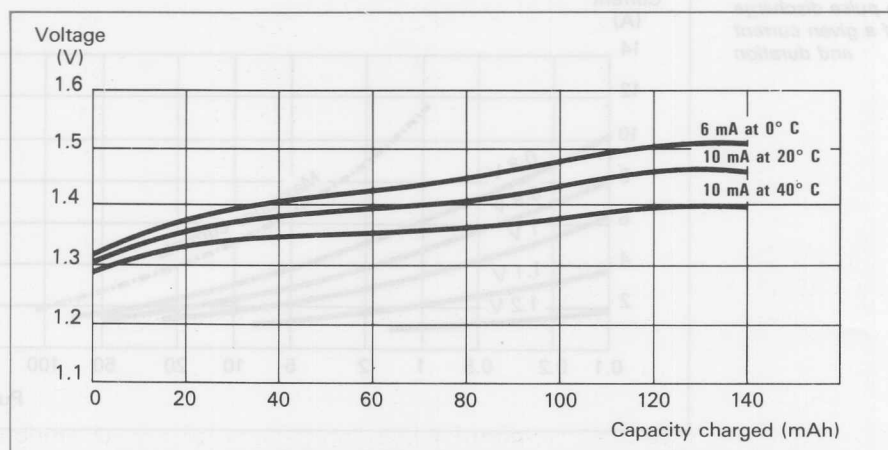
1. CHARGE A. Normal charge (irrespective of state of charge)

- from $+10^{\circ}\text{C}$ to $+50^{\circ}\text{C}$: 10 mA for 16 hours.
- from -30°C to $+10^{\circ}\text{C}$:

Temperature	Maximum charge rate	Charge time
$^{\circ}\text{C}$	mA	h
-30	1	100
-20	2	55
-10	4	30
0	6	20
+10	10	16

Note : Occasional overcharges at these rates beyond the prescribed times is not detrimental to VB 10 E cells.

Cell voltage for various charging rates and temperatures



VB
10E

B. Rapid and ultra-rapid charge

A larger or smaller part of the capacity can be charged in times from a few seconds to an hour with chargers approved by SAFT.

C. Continuous charge

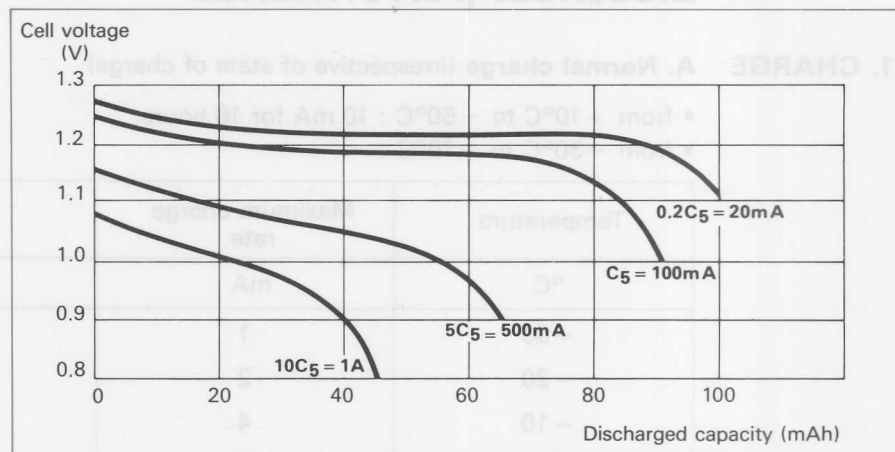
The continuous charge rate can vary from 0.5 mA to 5 mA. Maximum rates depend on the temperature.

Temperature °C	Max. continuous charge rate mA
-30	0.5
-20	1
-10	2
0	3
+10 to +50	5

2. DISCHARGE

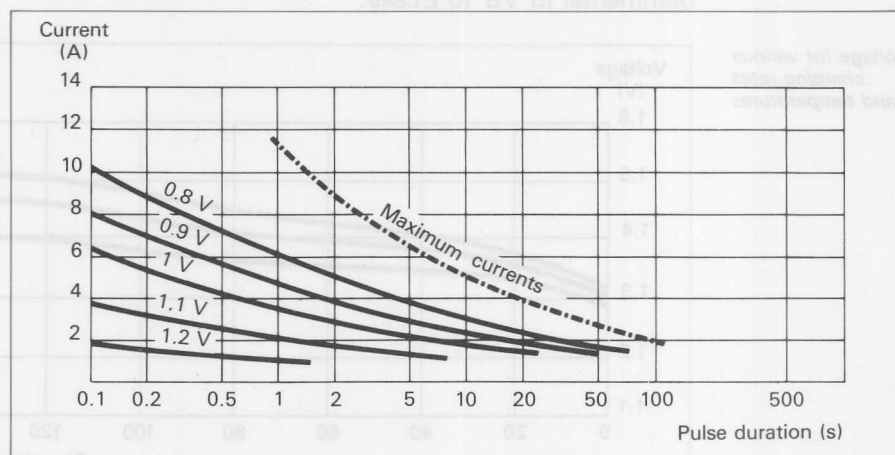
Continuous discharge at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
Maximum permissible continuous rate : 1 A.

*Voltage and capacity
for various
discharge rates*



Pulse discharge at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ (100 % charged).
Maximum power for a 0.3 s pulse : 7 W ($V = 0.65 \text{ V} - I = 11 \text{ A}$).

*Cell voltage
for a pulse discharge
of a given current
and duration*



Note : These data apply to SAFT VB 10 E battery packs.

2. VB 10 E battery packs

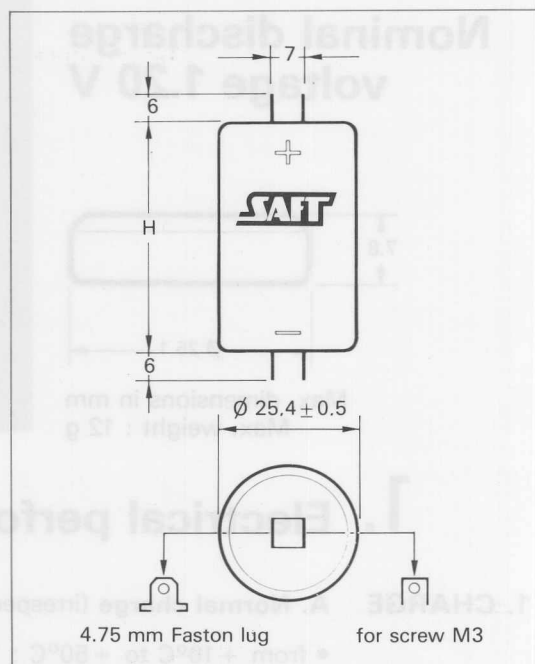
1. STANDARD BATTERIES OF VB 10 E CELLS

Rated capacity $C_5 = 100 \text{ mAh}$
Nominal voltage = 2.4 to 12 volts

A. Description

- Assembly in rigid plastics tube.
- Output terminals consisting of two blades each :
 - one provided with a hole for 3 mm dia. screw,
 - the other is a 4.75 mm Faston lug which may be used as a solder lug (drilled 1.4 mm dia.).

B. Dimensions (in mm)



Battery characteristics according to the number of cells.

Consult us
for batteries
of more than
12 V

No. of cells	U volts	VB 10 E reference	H ± 0.5	Max. weight (g)
2	2.4	127999	18.2	24
3	3.6	128000	22.6	32
4	4.8	122556	28	40
5	6	127392	33.4	48
6	7.2	125210	38.8	57
7	8.4	127271	44.2	65
8	9.6	128001	49.6	73
9	10.8	128002	55	81
10	12	125306	60.4	89

2. VB 10 E BATTERIES TYPE T

- Assembly in shrink sleeve.
 - Terminals : solder lugs or positive cap.
- Dimensions specified in SAFT outline No 320128.

3. VB 10 E BATTERIES TYPE R

- Cells assembled in a resin-potted plastics case.
 - Output terminals : Faston lugs.
- Dimensions specified in SAFT outline No 320167.

Note : For memory backup applications refer to «Memoguard R» battery manual.

VB
10E

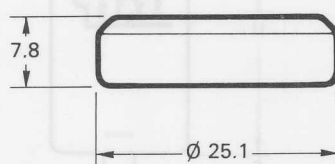
Cell type VB 22 E

(CEI : KBH 26/8)

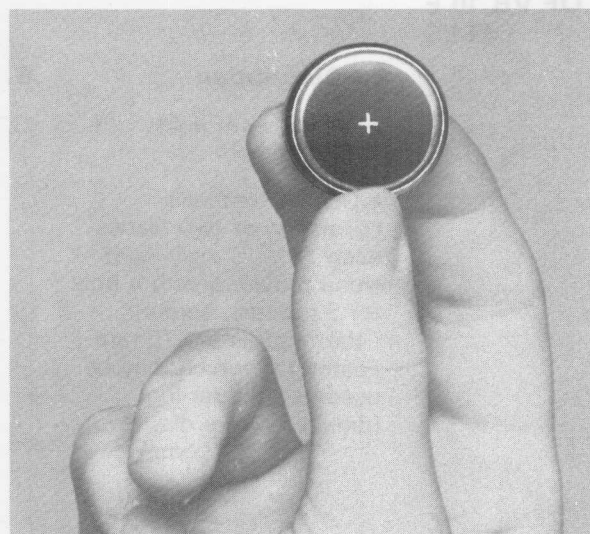
Rated capacity

C_5 : 220 mAh

Nominal discharge
voltage 1.20 V



Max. dimensions in mm
Max. weight : 12 g



1. Electrical performance

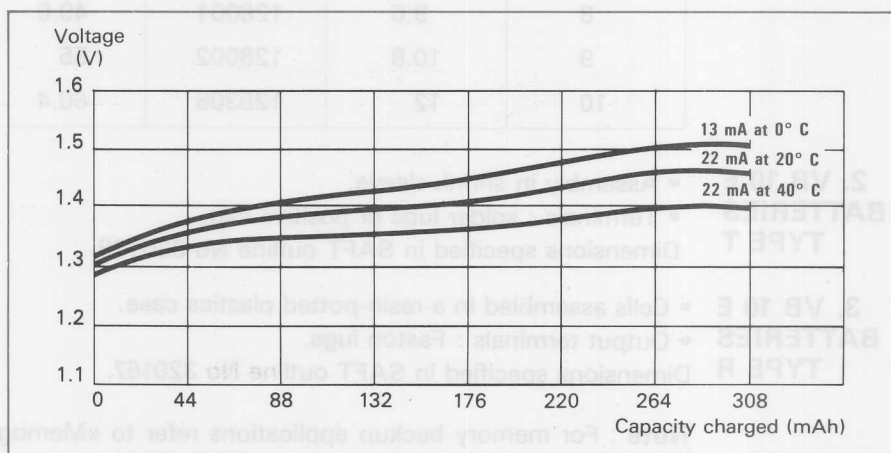
1. CHARGE A. Normal charge (irrespective of state of charge)

- from +10°C to +50°C : 22 mA for 16 hours.
- from -30°C to +10°C :

Temperature	Maximum charge rate	Charge time
°C	mA	h
-30	2,2	100
-20	4	55
-10	8	30
0	13	20
+10	22	16

Note : Occasional overcharges at these rates beyond the prescribed times is not detrimental to VB 22 E cells.

Cell voltage for various
charging rates
and temperatures



VB
22E

B. Rapid and ultra-rapid charge

A larger or smaller part of the capacity can be charged in times from a few seconds to an hour with chargers approved by SAFT.

C. Continuous charge

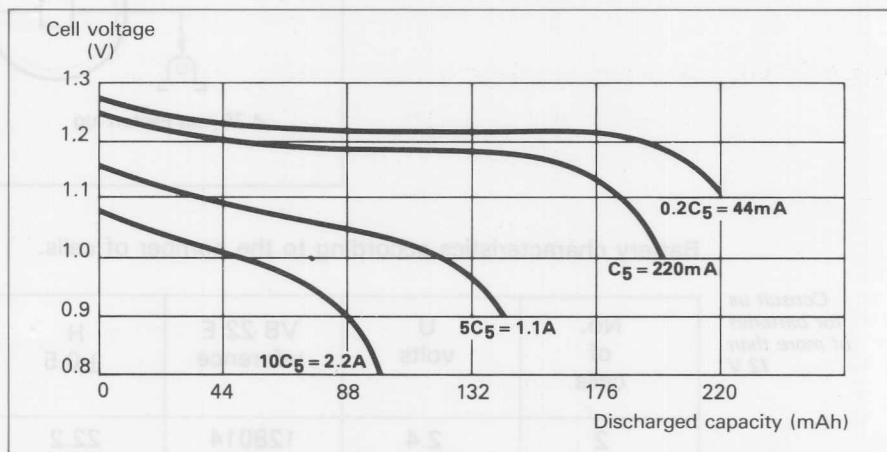
The continuous charge rate can vary from 1 mA to 11 mA.
Maximum rates depend on the temperature.

Temperature	Max. continuous charge rate
°C	mA
-30	1
-20	2
-10	4.5
0	6.5
10 to + 50	11

2. DISCHARGE

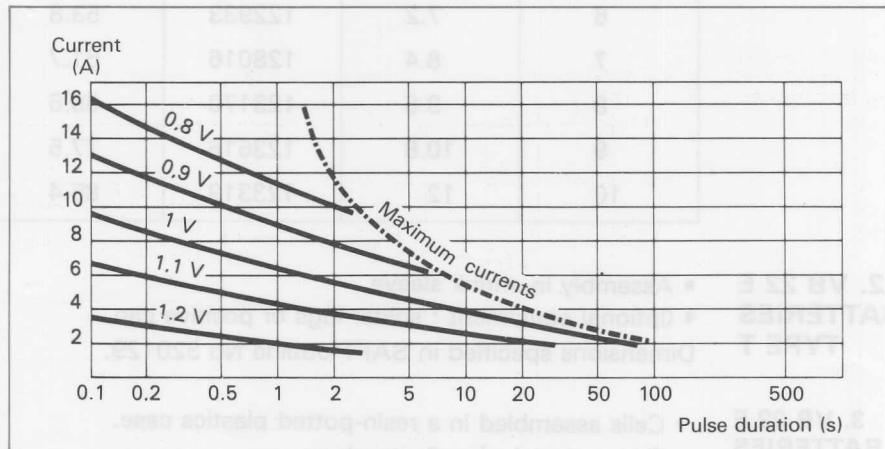
Continuous discharge at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
Maximum permissible continuous rate : 2.2 A.

Voltage and capacity for various discharge rates



Pulse discharge at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ (100 % charged).
Maximum power for a 0.3 s pulse : 12 W ($U=0.65\text{ V} - I=18.5\text{ A}$).

Cell voltage for a pulse discharge of a given current and duration



Note : These data apply to SAFT VB 22 E battery packs.

VB
22E

2. VB 22 E battery packs

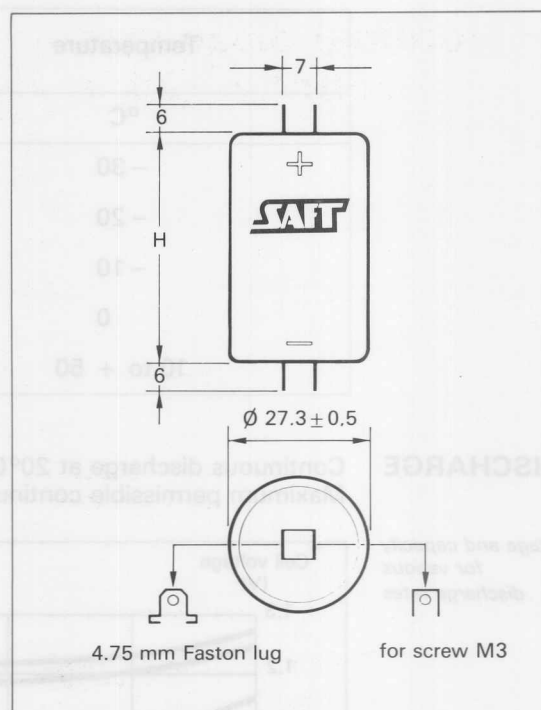
1. STANDARD BATTERIES OF VB 22 E CELLS

Rated capacity $C_5 = 220 \text{ mAh}$
Nominal voltage = 2.4 to 12 volts

A. Description

- Assembly in rigid plastics tube.
- Output terminals consisting of two blades each :
 - one provided with a hole for 3 mm dia. screw,
 - the other is a 4.75 mm Faston lug to which a wire may also be soldered (drilled 1.4 mm dia).

B. Dimensions (in mm)



Battery characteristics according to the number of cells.

Consult us
for batteries
of more than
12 V

No. of cells	U volts	VB 22 E reference	H ± 0.5	Max. weight (g)
2	2.4	128014	22.2	36
3	3.6	128015	30.1	49
4	4.8	127557	38	63
5	6	127393	45.9	76
6	7.2	122933	53.8	90
7	8.4	128016	61.7	104
8	9.6	123170	69.6	117
9	10.8	123616	77.5	131
10	12	123319	85.4	144

2. VB 22 E BATTERIES TYPE T

- Assembly in shrink sleeve.
 - Optional equipment : solder lugs or positive cap.
- Dimensions specified in SAFT outline No 320129.

3. VB 22 E BATTERIES TYPE R

- Cells assembled in a resin-potted plastics case.
 - Output terminals : Faston lugs.
- Dimensions specified in SAFT outline No 320169.

VB
22E

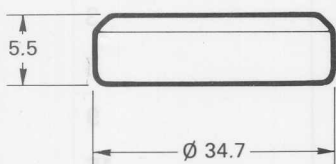
Cell type VB 30 E

(CEI : KBH 35/6)

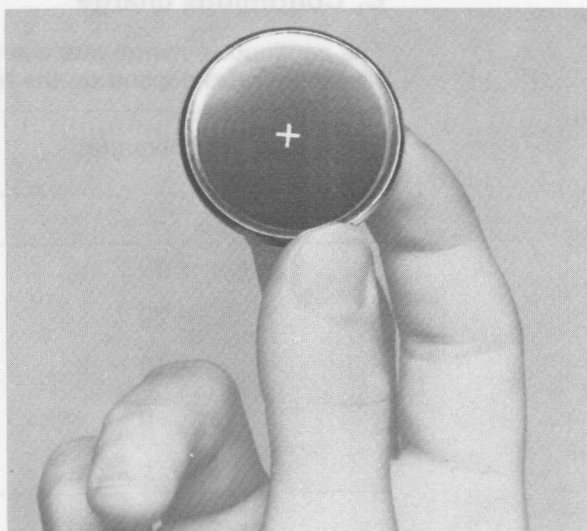
Rated capacity

C₅ : 300 mAh

**Nominal discharge
voltage 1.20 V**



Max. dimensions in mm
Max. weight : 18 g



1. Electrical performance

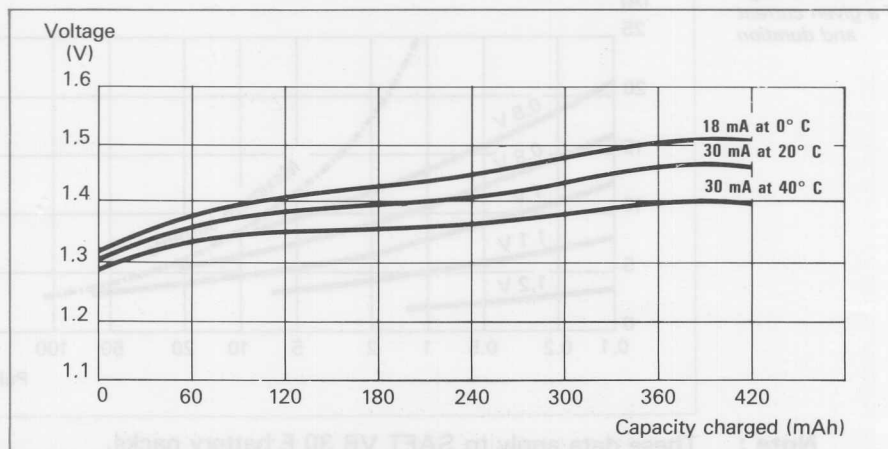
1. CHARGE A. Normal charge (irrespective of state of charge)

- from +10°C to +50°C : 30 mA for 16 hours.
- from -30°C to +10°C :

Temperature	Maximum charge rate	Charge time
°C	mA	h
-30	3	100
-20	6	55
-10	11	30
0	18	20
+10	30	16

Note : Occasional overcharges at these rates beyond the prescribed times is not detrimental to VB 30 E cells.

Cell voltage for various
charging rates
and temperatures



**VB
30E**

B. Rapid and ultra-rapid charge

A larger or smaller part of the capacity can be charged in times from a few seconds to an hour with chargers approved by SAFT.

C. Continuous charge

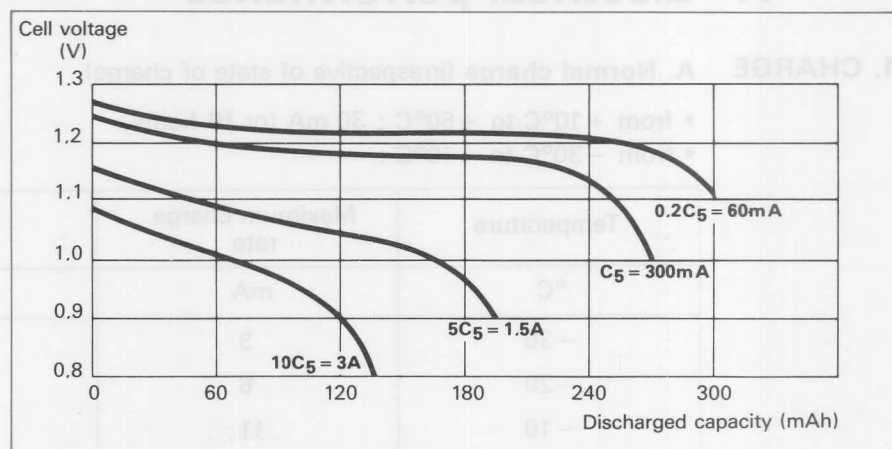
The continuous charge rate can vary from 1.5 mA to 15 mA. Maximum rates depend on the temperature.

Temperature	Max. continuous charge rate
°C	mA
-30	1.5
-20	3
-10	5
0	9
+ 10 to + 50	15

2. DISCHARGE

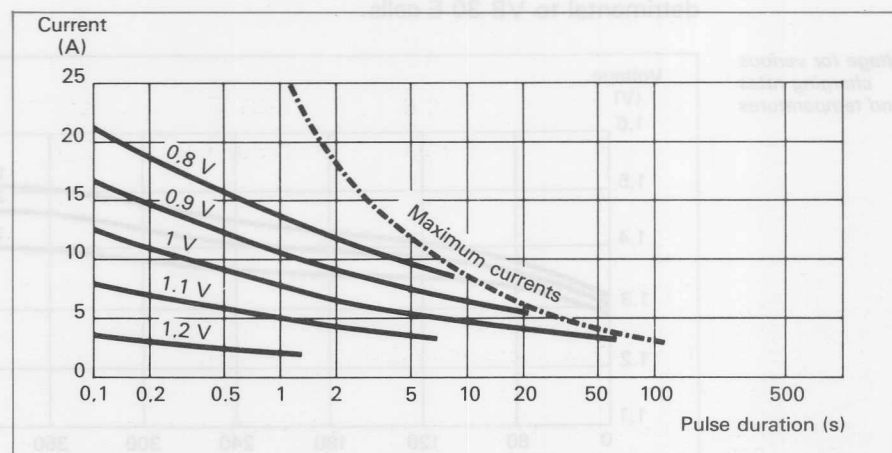
Continuous discharge at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
Maximum permissible continuous rate : 3 A.

Voltage and capacity for various discharge rates



Pulse discharge at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ (100 % charged).
Maximum power for a 0.3 s pulse : 15 W ($U=0.65\text{ V} - I=23\text{ A}$).

Cell voltage for a pulse discharge of a given current and duration



Note : These data apply to SAFT VB 30 E battery packs.

VB
30E

2. VB 30 E battery packs

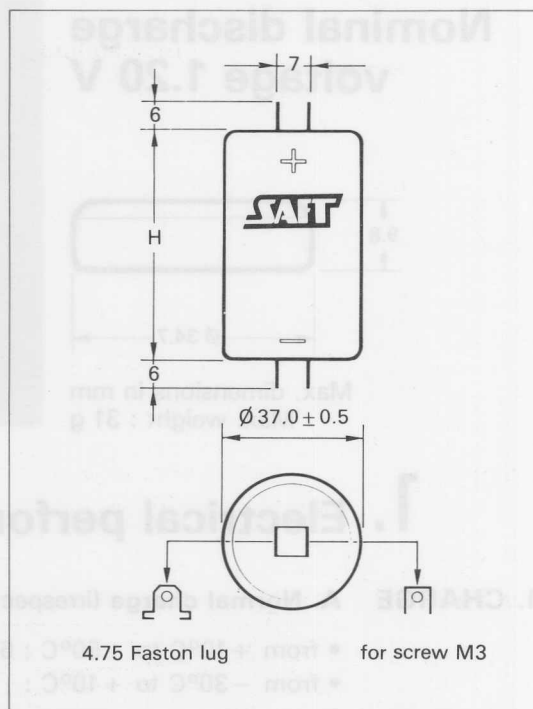
1. STANDARD BATTERIES OF VB 30 E CELLS

Rated capacity $C_5 = 300 \text{ mAh}$
Nominal voltage = 2.4 to 12 volts

A. Description

- Assembly in rigid plastics tube.
- Output terminals consisting of two blades each :
 - one provided with a hole for 3 mm dia. screw,
 - the other is a 4.75 mm Faston lug to which a wire may also be soldered (drilled 1.4 mm dia).

B. Dimensions (in mm)



Battery characteristics according to the number of cells.

Consult us
for batteries
of more than
12 V

No. of cells	U volts	VB 30 E reference	H $\pm 0,5$	Max. weight (g)
2	2.4	128028	18.4	56
3	3.6	125192	24	76
4	4.8	127556	29.6	97
5	6	125982	35.2	117
6	7.2	124088	40.8	138
7	8.4	123194	46.4	158
8	9.6	123195	52	179
9	10.8	128029	57.6	199
10	12	125983	63.2	220

2. VB 30 E BATTERIES TYPE T

- Assembly in shrink sleeve.
 - Optional equipment : solder lugs, positive cap.
- Dimensions specified in SAFT outline No 320130.

3. VB 30 E BATTERIES TYPE R

- Cells assembled in a resin-potted plastics case.
 - Output terminals : Faston lugs.
- Dimensions specified in SAFT outline No 320171.

VB
30E

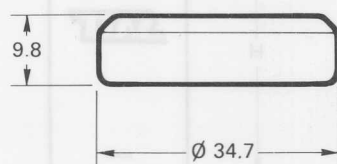
Cell type VB 60 E

(CEI : KBH 35/10)

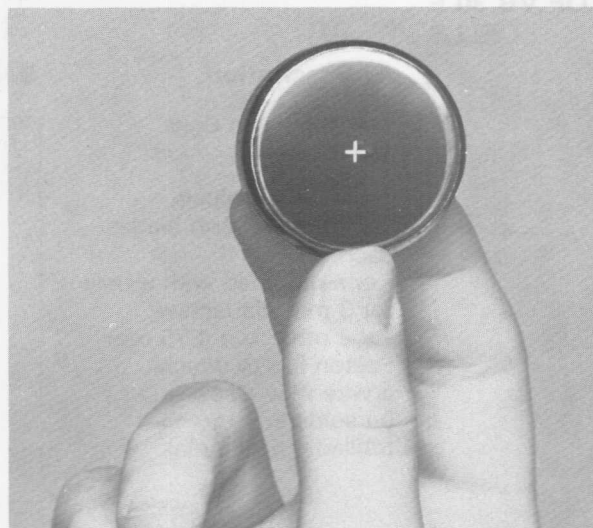
Rated capacity

C_5 : 600 mAh

Nominal discharge
voltage 1.20 V



Max. dimensions in mm
Max. weight : 31 g



1. Electrical performance

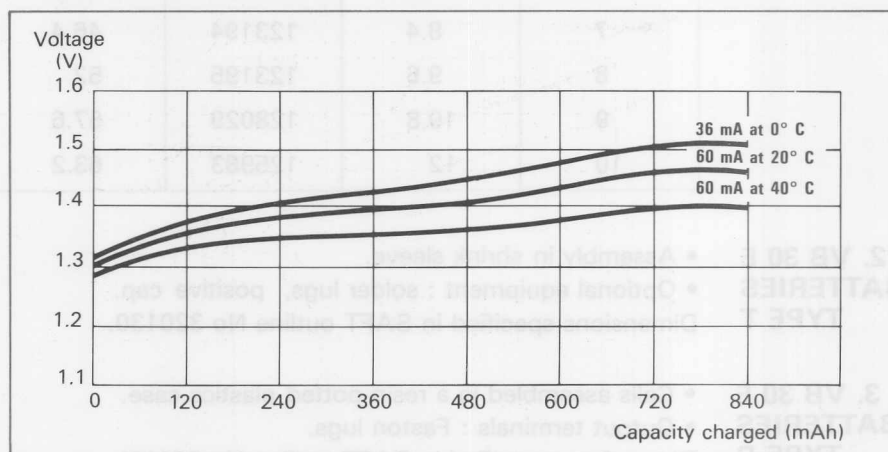
1. CHARGE A. Normal charge (irrespective of state of charge)

- from +10°C to +50°C : 60 mA for 16 hours.
- from -30°C to +10°C :

Temperature	Maximum charge rate	Charge time
°C	mA	h
-30	6	100
-20	12	55
-10	21	30
0	36	20
+10	60	16

Note : Occasional overcharges at these rates beyond the prescribed times is not detrimental to VB 60 E cells.

Cell voltage for various
charging rates
and temperatures



B. Rapid and ultra-rapid charge

A larger or smaller part of the capacity can be charged in times from a few seconds to an hour with chargers approved by SAFT.

C. Continuous charge

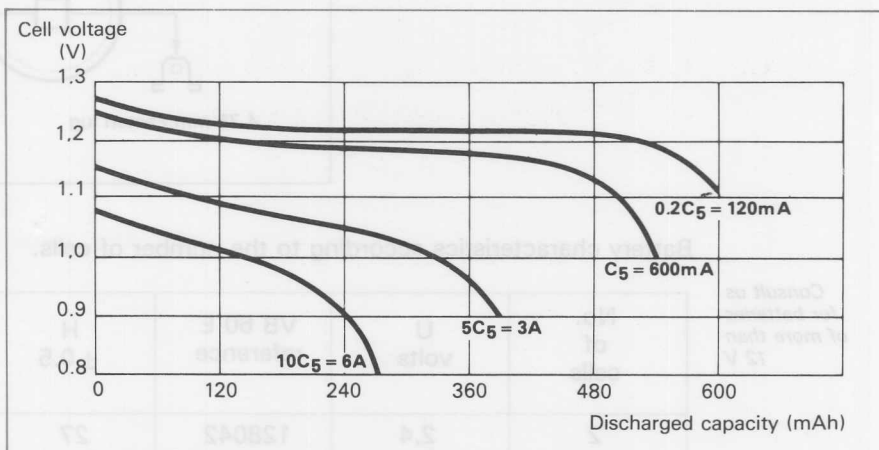
The continuous charge rate can vary from 3 mA to 30 mA. Maximum rates depend on the temperature.

Temperature	Max. continuous charge rate
°C	mA
-30	3
-20	6
-10	11
0	18
+10 to +50	30

2. DISCHARGE

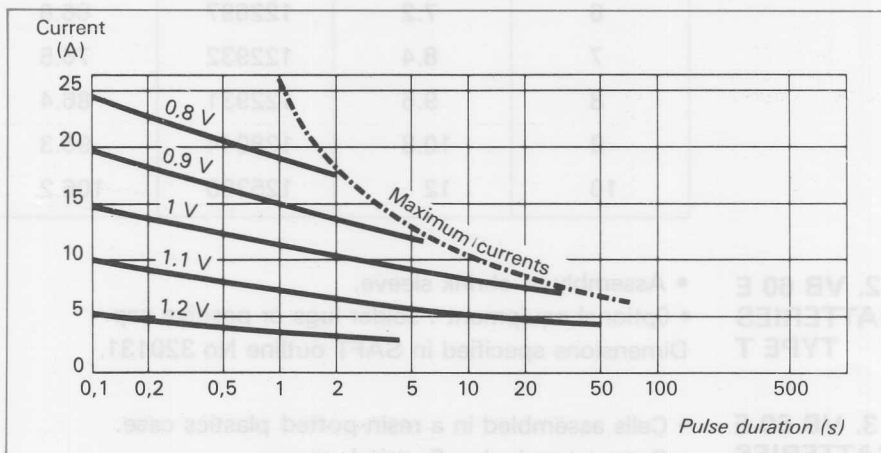
Continuous discharge at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
Maximum permissible continuous rate : 6 A.

Voltage and capacity
for various
discharge rates



Pulse discharge at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ (100 % charged).
Maximum power for a 0.3 s pulse : 19 W ($U = 0.65\text{ V} - I = 29\text{ A}$).

Cell voltage
for a pulse discharge
of a given current
and duration



Note : These data apply to SAFT VB 60 E battery packs.

VB
60E

2. VB 60 E battery packs

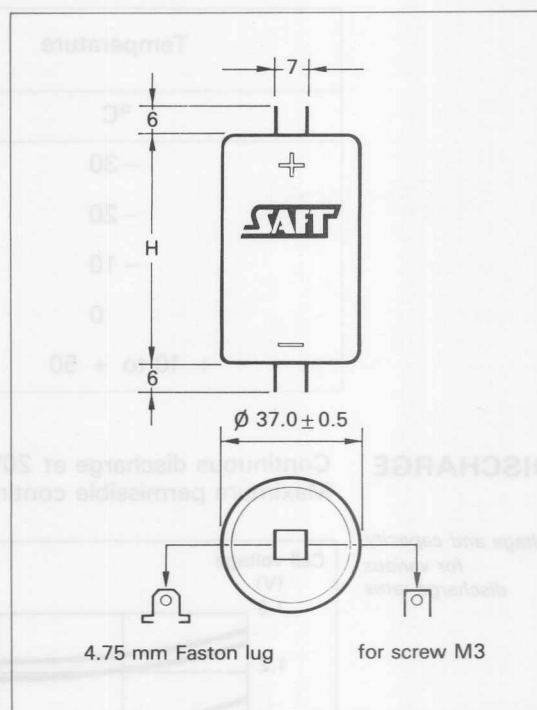
1. STANDARD BATTERIES OF VB 60 E CELLS

Rated capacity $C_5 = 600 \text{ mAh}$
Nominal voltage = 2.4 to 12 volts

A. Description

- Assembly in rigid plastics tube.
- Output terminals consisting of two blades each :
 - one provided with a hole for 3 mm dia. screw,
 - the other is a 4.75 mm Faston lug to which a wire may also be soldered (drilled 1.4 mm dia).

B. Dimensions (in mm)



Battery characteristics according to the number of cells.

*Consult us
for batteries
of more than
12 V*

No. of cells	U volts	VB 60 E reference	H ± 0.5	Max. weight (g)
2	2.4	128042	27	88
3	3.6	128043	36.9	117
4	4.8	122557	46.8	152
5	6	126443	56.7	186
6	7.2	122697	66.6	221
7	8.4	122932	76.5	255
8	9.6	122931	86.4	290
9	10.8	128044	96.3	324
10	12	125380	106.2	359

2. VB 60 E BATTERIES TYPE T

- Assembly in shrink sleeve.
 - Optional equipment : solder lugs or positive cap.
- Dimensions specified in SAFT outline No 320131.

3. VB 60 E BATTERIES TYPE R

- Cells assembled in a resin-potted plastics case.
 - Output terminals : Faston lugs.
- Dimensions specified in SAFT outline No 320173.